

Black and Red Cards

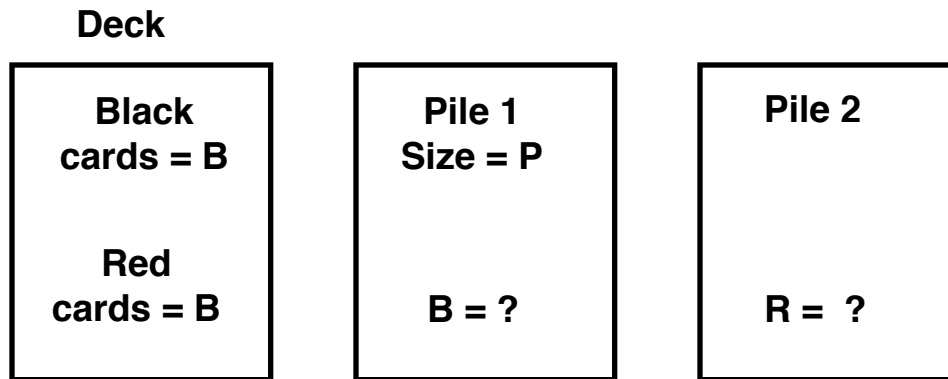
Shuffle a deck of cards, then deal 30 cards into a pile. Place the remaining cards in a second pile. Count the number of **black cards that are in the first pile**. Now count the number of **red cards that are in the second pile**. What is the difference between the two numbers.

Use a normal full deck of 52 cards. The deck has 26 red cards and 26 black cards

1. Have a student deal 30 cards into a pile in front of them. Call this the first pile. Have them set the remaining cards in a second pile apart from the first pile.
2. Ask the student to count the number of **black cards in the first pile** but do not tell you that number. You may want to have him write the number down.
3. Ask the student to count the number of **red cards in the second pile** but do not tell you that number. You may want to have them write the number down.
4. Ask them to subtract the smaller of the 2 number from the larger number.
5. Remind the student that you were not told the number or black or red cards. Yet you predict the difference between the two number will be 4.

Repeat the trick with a different number of cards.

1. Have the student deal out some black cards one at a time. Count the cards as they deal them. **(Think of the number of black cards as B)**
2. Have the student deal out the same number of red cards one at a time. Have the student collect the cards into one pile and shuffle the cards.
3. Have a student deal as many of the cards in the deck as they wish into a pile in front of them. Call this the first pile. Count these cards as they are dealt out. **(Think of this number as P)**. Have them set the remaining cards in a second pile apart from the first pile.
4. Ask the student to count the number of **black cards in the first pile** but do not tell you that number. You may want to have him write the number down.
5. Ask the student to count the number of **red cards in the second pile** but do not tell you that number. You may want to have them write the number down.
4. Ask them to subtract the smaller of the 2 number from the larger number.
5. Remind the student that you were not told the number or black or red cards. Yet you predict the difference between the two number will be **P – B**.



**The difference between the black cards in pile 1
and the red cards in pile 2 is
B – P**

First Trick with 52 cards (26 red and 26 black). **B = 26**

The first pile contains 30 cards P = 30

The difference between the number of black in the first pile and the number of red cards in the second deck will always be 4.

There are 52 cards in the deck. There are 26 black cards and 26 red cards.

The first pile contains 30 cards. If there are **18 black cards in the first pile**, then the number of red cards will be $30 - 18$ or 12 red cards.

There are $26 - 18 = 8$ black cards in the second deck. The number of red cards in the second pile is $26 - 12 =$ **14 red cards in the second pile**.

The difference between the **18 black cards in Pile 1** and the **14 red cards in the Pile 2** is 4

Why this works.

There are 52 cards in the deck. There are 26 black cards and 26 red cards.

The first pile contains 30 cards.

Let the number of black cards in the first pile be x .

The number of red cards in the first pile is $30 - x$.

The number of black cards in the second pile is $26 - x$.

The number of red cards in the second pile is $26 - (30 - x) = x + 4$.

**The difference between the number of black cards in the first pile (x)
and the number of red cards in the second pile ($x + 4$) is 4**

A proof that the difference is $B - P$

The deck has $2B$ cards in it. There are m black cards (**B**) and m red cards.

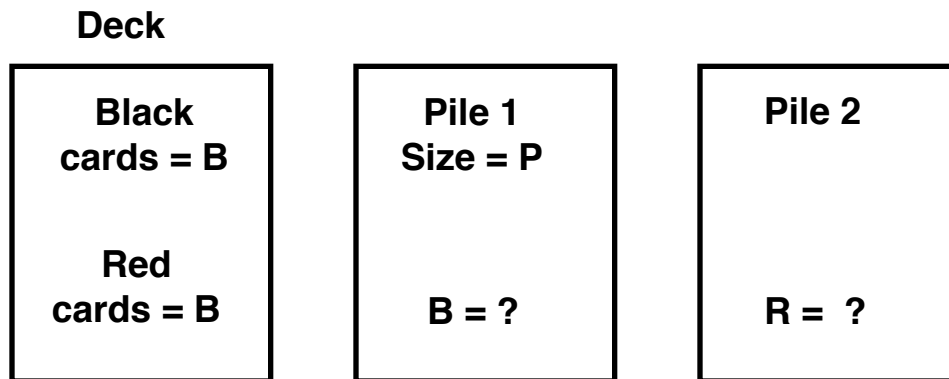
The first pile has P cards in it. x black cards and $P - x$ red cards.

The number of black cards in the second pile is $m - x$.

The number of red cards in the second pile is $B - (P - x) = B - P + x$

The difference $B - P + x - x$

$= B - P$



**The difference between the black cards in pile 1
and the red cards in pile 2 is
 $B - P$**

Example 1:

The deck has 28 cards in it. 14 Black and 14 Red. **$B = 14$**

The first pile has 12 cards in it. **$P = 12$** and contains **8 black cards**. so it must contain 4 red cards.

The 2nd pile has $28 - 12 = 16$ cards.

It contains the remaining 6 black cards and the remaining **10 red cards**.

The difference between the black cards in the first pile and the red cards in the second pile is 2.

$B - P = 14 - 12 = 2$

Example 2:

The deck has 22 cards in it. 11 Black and 11 Red. **$B = 11$**

The first pile has 15 cards in it. **$P = 15$** and contains **9 black cards**. so it must contain 6 red cards

The 2nd pile has $22 - 15 = 7$ cards.

It contains the remaining 2 black cards and the remaining **5 red cards**.

The difference between the black cards in the first pile and the red cards in the second pile is 4.

$B - P = 15 - 11 = 4$